Homework, Lesson 6

Problem 1

You are responsible for designing a pizza dough press that will transform a spherical ball of pizza dough into a flat pizza crust. The creation of the flat-disk crust is a two-step process:

State 1: Spherical ball of dough with diameter D_1 and density $\rho_1 = \rho_{raw}$

Process 1→2: Sphere is compressed into a cylinder.

State 2: Vertical, cylinder of dough with diameter $D_2 = D_1$, height H, and density $\rho_2 = \rho_{raw}$

Process 2→3: Cylinder is flattened until it has radius $r = R$ and thickness δ.

State 3: Flat, disk of dough with radius R and thickness δ and density $\rho_3 = 0.90 \, \rho_{raw}$
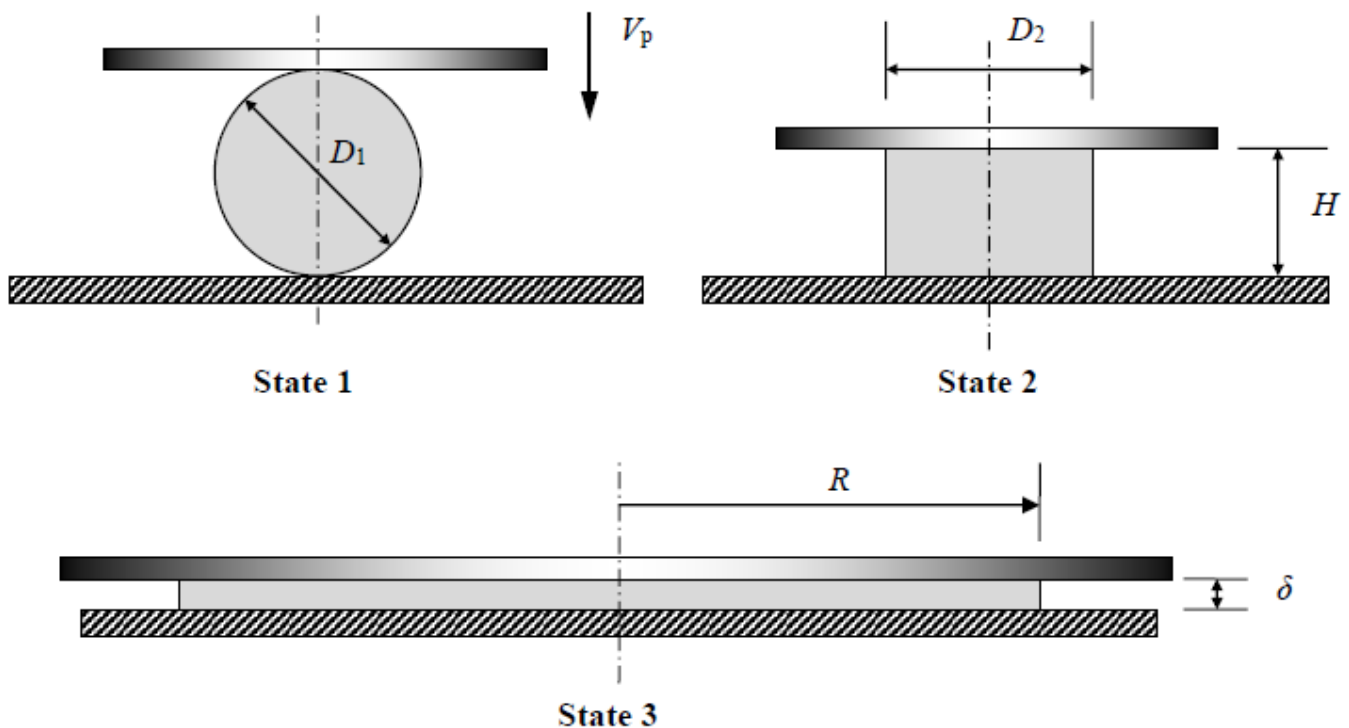

Figure 1: Three states in smashing pizza dough

(a) Determine the relationship between the dough cylinder height (H) in State 2 and the dough-ball diameter (D_1) in State 1.
(b) Determine the relationship at State 3 between the pizza crust radius R, the pizza crust thickness δ, and the original dough ball diameter D_1.
(c) At State 3, determine how fast the edge of the pizza dough crust advances (dR/dt) in terms of the time-rate-of-change of the pizza thickness ($d\delta/dt$).
(d) What diameter of dough ball is required to make a 40-cm diameter pizza crust that is 6-mm thick?